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An Intelligent Helmet System using IoT and Raspberry Pi

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Abstract

The impact when a motorcyclist involves in a high-speed accident without wearing a helmet is very dangerous and can cause fatality. Wearing a helmet can reduce shock from the impact and may save a life. There are many countries enforcing a regulation that requires the motorcycle's rider to wear a helmet when riding on their motorcycle, Malaysia is an example. This paper is all about providing a solution to the bikers by connecting helmet and ignition switch electronically. The helmet is equipped with a sensor which can sense whether the person is with helmet or not. The helmet and bike relate to a wireless system, whenever the rider removes the helmet a signal is send to the receives at the bike ignition and is switched OFF and it is vice versa.

1. INTRODUCTION

Wearing a helmet is must for everybody during the bike or tow-wheeler riding. Generally, accidents are the most cases where the people led to premature death due to head injuries since the difficulty, sensitiveness and complicated structure of human brain. As we can see that government has mandate everyone to wear a helmet in recent days, but most of the rural areas still not considering this as a serious issue since there are no such strict rules and regulations assumed in urban cities. Hence, this paper introduced an intelligent helmet system with incorporation of ignition circuit with the helmet where the bike will start in presence of both helmet and a key, which in results mitigates the cause of head injury in case of any accident occurs. Current scenario disclosed that most of the people died in accidents were happened with two-wheeler vehicles like bike and scooter etc. Therefore, it is required to provide some safety for a rider to reduce the major head injurie in accidental cases.

2. RELATED WORK

Author in [4] addressed a smart helmet system using Bluetooth. Additionally, detection of accidents and consumption of alcohol also implemented with usage of several sensors like impact, accelerometer, flex and breath analyser. In [5], authors described an innovative approach named smart helmet for another application like traffic control scenario. Author in [6] addressed the usage and significance of helmet and assist people to lead them safe. They utilized RF-based helmet detection approach, which comprises of both transmitter and receiver modules. Das et al. presents a novel and intelligent helmet that assures the bike will get start if the rider wears a helmet [7]. When the rider wears the helmet then it triggers the switch of ignition circuit. The bike starts only if there is both key and helmet with the rider.In [8], Gudavalli et al. proposed couple of safety systems for bike riders where the first one includes security engine system which consists of RFID reader and tags. The latter is safety engine system, which enables the bike on or off state when the rider wears helmet.

3. PROPOSED SYSTEM

In this proposed system a low cost and effective RF transponder which consists of a transmitter and receiver is used. The transmitter is placed in the helmet and receiver is placed in vehicle so whenever the emergency vehicle approaches to the range of the transmitter a code is sent. In the proposed model, a microcontroller is coded for both transmitting and getting part and set. The transmitter part is placed in the helmet and the receiving part is set in vehicle, so correspondence happens just when the

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transmitter part lands at the range.It is already mentioned that the project is divided into twounits namely helmet and bike.

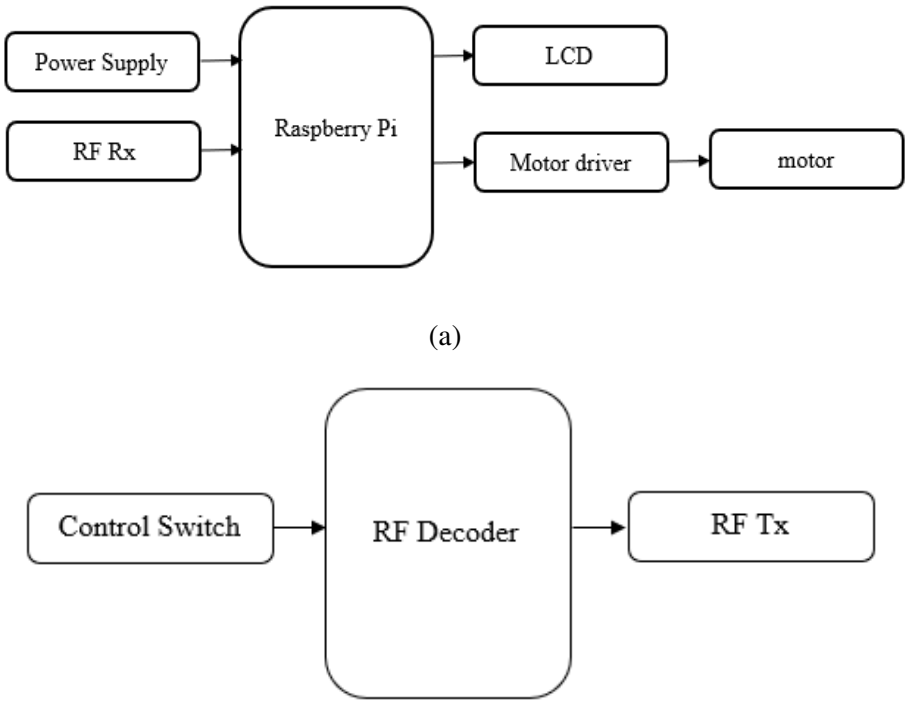

Figure 1. Proposed block diagram of intelligent helmet system (a) vehicle unit. (b) helmet unit.

In helmet unit, also called the transmitter unit shown in Figure 1 (a), the force sensing resistor is placed on inside upper part of the helmet where head will touch with sensor surface. And alcohol sensor is placed on in front of rider's mouth so that it can sense easily. Solar panels are mounted on upper side of helmet which is in direct sunlight. And the battery and regular circuits were fixed inside the helmet. Secondary controller and RF transmitter circuit were also placed inside the helmet. Antenna is located outside the helmet. The first step of project is it initializes all the port and next step is accident detection using accelerometer. If No accident occurs, then it will go to third step. Third step is listening to RF module continuously for Data and interprets data using if conditions. Fourth step is to checkweather helmet is wear or not. If Helmet is not wearing, then display Message "Please wear the helmet" will be displayed. Next step is to check the condition of drunk, if rider is drunk, display message "You are Drunk" and then send the message to stored number with location and ask for the password. If password is correct, then bike will start. If accident is detected in sixth step, then it will stop everything and send a message with location.The helmet is setup with one RF Tx module which can be triggered using a small switch. Whenever it receives the signal point. The RF Rx module at signal receives the signal from Tx and make the vehicle on

4. HARDWARE DESCRIPTION

Liquid Crystal Display

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LCD is liquid crystal display technology works by blocking light. Specifically, it is made of two pieces of polarized glass that contain a liquid crystal material between them. A backlight creates light that passes through the first substrate. It is used for display purpose.

Figure 2. LCD display

Raspberry Pi

It is an ultra-cheap minicomputer with 5.5 cm width and 9 cm length. It consists of a component named System on Chip (SoC) which comprises of single core CPU with a supportive processor for computing floating points, GPU and RAM with 512 MB size (SD-RAM). Moreover, it consumes less power, which is just around 5-7 watts. The architecture of raspberry pi is given in figure 6. It has couple of cache memory levels, where first level is of 32KB size and the latter is of 128KB size. These are utilized to store recent programs and ALU is utilized to execute instructions.

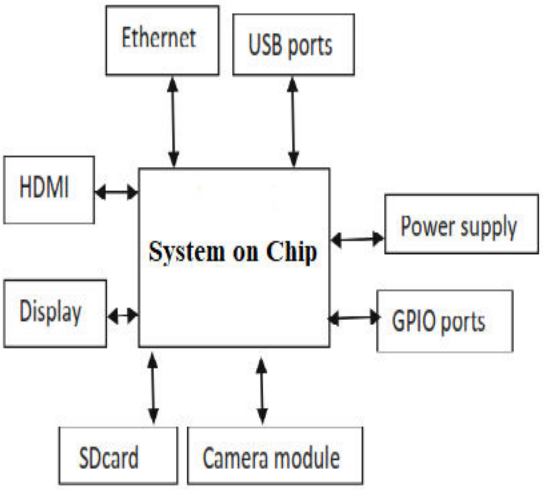

Figure 3. System architecture of raspberry pi

Table 1. Specifications of Raspberry pi

Chip	Broadcom BCM2835 SoC
Core architecture	ARM 11
CPU	700 MHz Low power ARM1176JZFS
RAM	512 MB (SD-RAM)
OS	Linux
Dimensions	85.6 × 53.98 × 17 mm
Power	Micro USB socket, 5 V, 1.2 A

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It is a very small device and can incorporate other devices also. It consists of both the hardware and software. It requires an SD card and a power supply to related mouse and keyboard. Additionally, a display also exists for functioning OS such as Windows and Linux.

Figure 4. Raspberry pi

RF Module

The RF module, as the name suggests, operates at Radio Frequency. The corresponding frequency range varies between 30 kHz & 300 GHz. In this RF system, the digital data is represented as variations in the amplitude of carrier wave. This kind of modulation is known as Amplitude Shift Keying (ASK).

Motor Driver

The L298N driver module is used to drive the motors.The L298N is an integrated monolithic circuit in a 15- lead Multiwatt and PowerSO20 packages. It is a high voltage , high current dual full-bridge driver de-signed to accept standard TTL logic level sand drive inductive loads such as relays, solenoids, DC and stepping motors. Two enable inputs are provided to enable or disable the device independently of the in-put signals .An additional Supply input is provided so that the logic works at a lower voltage.

DC motor

A DC motor is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current flow in part of the motor.DC motors were the first form of motor widely used, as they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings. Small DC motors are used in tools, toys, and appliances. The universal motor can operate on direct current but is a lightweight brushed motor used for portable power tools and appliances. Larger DC motors are currently used in propulsion of electric vehicles, elevator and hoists, and in drives for steel rolling mills. The advent of power electronics has made replacement of DC motors with Ac motors possible in many applications.

5. EXPERIMENTAL RESULTS

Hardware circuit of proposed intelligent helmet system is disclosed in figure 5, where initially rider didn't wear the helmet which is displayed in LCD screen that no helmet exists hence ignition is in OFF condition. Figure 6 shown that ON condition of ignition when the helmet exists as we can see in

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the LCD screen. In this way, our proposed system provides a safety to the rider with ignition OFF when he doesn't wear a helmet.

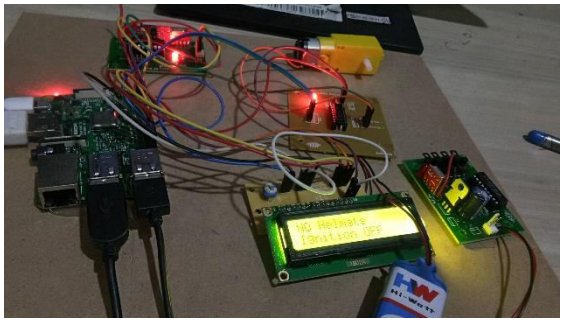

Figure 5. Hardware circuitry of proposed intelligent helmet system.

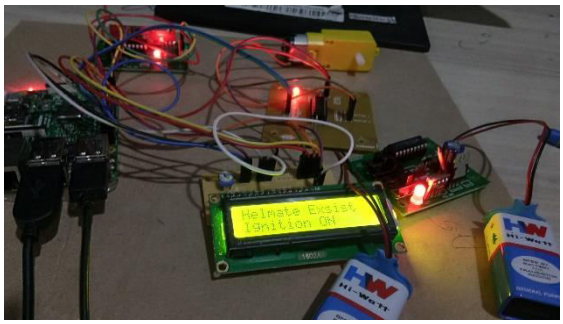

Figure 6. Condition of ignition ON when the helmet exists.

6. CONCLUSIONS

This article proposed an intelligent helmet system to enable a safety journey by interfacing the helmet with ignition circuit which ensure that the bike will get start in case of having helmet only. This is very useful and can reduce the head injury during any accident. Further, this is very simple and easy in cheaper cost.

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